Appendix G

Traffic Analysis Results

Appendix G

Traffic Analysis Methodology and Modeling Results

The traffic analysis for the Hayward Circulation Element Update has relied on existing count data to address existing conditions and the Alameda County Congestion Management Agency (ACCMA) Countywide Model as a forecasting tool for future conditions. The ACCMA Model is a regional travel demand model that includes the entire Bay Area, but is more focused in Alameda County. The model is a traditional "4-step" process that includes trip generation, trip distribution, mode choice and trip assignment. The model inputs are based on socio-demographic data supplied by the Association of Bay Area Governments (ABAG) at the Census Tract Level and then disaggregated to the finer Traffic Analysis Zones (TAZ) by local jurisdictions. The current version of the model uses ABAG Projections 2000 with forecasts for year 2005 and year 2025. The last model calibration was conducted in 1996 for year 1990 conditions.

Although the 1996 model update provided additional network and zonal detail in Hayward, this model is still not as detailed as the City of Hayward traffic model in the Hayward vicinity. Based on the detail level and the fact that the calibration year of 1990 is now outdated, this may affect the reliability of forecasts, especially at the individual intersection level. Therefore the traffic analysis methodology had to rely on considerable adjustment of future intersection turning volumes by comparing to existing counts, which represent the most reliable data source.

The following analysis focused primarily on level of service for links and intersections. This Circulation Element Update was primarily focused on network improvements without any changes in land use, so was not subject to the CMA Tier 1 Analysis.

Intersection Level of Service Methodology

The evaluation of level of service (LOS) presented in this chapter is based on methods outlined in the 1994 Highway Capacity Manual (HCM) (Transportation Research Board 1994). This older methodology has been used at the request of the City in order to be consistent with the 1998 Circulation Element, particularly for the calculation of Stopped Delay at signalized intersections. Under this method, the LOS at each direction of the analysis intersections is determined for existing and future conditions. The LOS assigned to the overall intersection is defined as the LOS of the movement with the worst conditions in the intersection. The rating system used to designate LOS at signalized intersections is shown in **Table 1**. The HCM also includes LOS criteria for unsignalized intersections, which are different than for signalized locations. LOS designations are assigned to particular minor movements, and are based on the average total delay for that movement. LOS is not defined for the intersection as a whole. Therefore, descriptions of expected delay at unsignalized intersections are generalized. **Table 2** details the LOS rating system for unsignalized intersections.

TRAFFIX Level of Service Software

The level of service calculations were conducted using the TRAFFIX software, developed by Dowling Associates, which provides the ability to organize all intersections and scenarios in one database. The TRAFFIX software has the ability to implement any level of service methodology, including the HCM-94 methodology for both signalized and unsignalized intersections. Data was

collected in the field and coded into the software. This includes counts, intersection geometries, signal control and phasing and signal timing plans (provided by the City, and only where available). All intersections were analyzed with a peak hour factor (PHF) of 0.95. Where information was not provided or available, the use of TRAFFIX defaults was allowed (for cycle length, lost time and minimum greens). As a quality check, the output obtained using TRAFFIX was compared to the HCS output from the 1998 Circulation Element and it was concluded that when using the same defaults and volumes, the two methodologies produced identical results in terms of delay and LOS.

Existing Intersection Analysis

The following local intersections in the City have been selected for analysis of traffic impacts and are consistent with the intersection in the 1998 Circulation Element. The location of the study intersections are graphically displayed in **Figure 1**.

1. Center Street & Kelly Street
2. Mission Boulevard & A Street
3. Foothill Boulevard & A Street
4. Mission/Foothill & Jackson
5. NB 880 Ramps & A Street
6. SB 880 Ramps & A Street
7. Hesperian Boulevard & A Street
8. Mission Boulevard & Carlos Bee Boulevard
9. Mission Boulevard & Harder Road
10. Mission Boulevard & Tennyson Road
11. Mission Boulevard & Industrial Parkway
12. Industrial Parkway SW & Industrial Parkway
13. NB-880 Ramps & Whipple Road
14. SB-880 Ramps & Whipple-Dyer Road
15. NB-880 Ramps & Industrial Parkway
16. SB-880 Ramps & Industrial Parkway
17. Hesperian Boulevard & EB-SR92 Ramps
18. Hesperian Boulevard & WB-SR92 Ramps
19. Industrial Boulevard & EB-SR92 Ramps
20. Industrial Boulevard & WB-SR92 Ramps
21. Clawiter Road & EB-SR92 Ramps
22. Clawiter Road & WB-SR92 Ramps
23. Hesperian Boulevard & W. Industrial Parkway
24. Santa Clara Street & Jackson Road
25. Santa Clara Street & Winton Avenue
26. Hesperian Boulevard & Winton Avenue
27. Santa Clara Street & A Street

Dowling Associates conducted traffic counts for the PM peak period for 21 of the study intersections during early June 2001. For the remaining intersections, recent counts dating from 1998 or 2000 were used. **Table A1** in the Technical Appendix provides the detailed counts for each turning movement for all study intersections for PM Peak Hour conditions. **Table 3** (Existing LOS for PM Peak Hour) shows a summary of the existing LOS conditions, including the calculated stopped delay in seconds per vehicle, for PM Peak Hour conditions for all study intersections. Using the 1994 HCM operations methodology, 19 of the 27 intersections analyzed currently operate at acceptable level of service (LOS D or better) during the PM Peak Hour.

Four intersections operate at marginal conditions (LOS E), while four intersections operate at LOS F or unacceptable conditions (including Foothill Boulevard & A Street, Foothill Boulevard & Jackson Street, NB-880 Ramps & Whipple Road and Santa Clara Street & Jackson Road). For further information on the intersection LOS calculations, refer to the detailed TRAFFIX calculation sheets provided in the Technical Appendix.

Demand Model Volume Adjustment

The ACCMA Countywide Model was used to provide future forecasts for two scenarios, (1) the Proposed Project, and (2) the Constrained Project. Prior to running the forecasts, the road network in the model was reviewed for errors and fixes were made to correct any, including, incorrect lanes on Mission Boulevard, incorrect ramp configurations and missing turn prohibitions at interchange ramps. This review only focused on Hayward and primarily near the vicinity of the study intersections.

Usually regional demand models do provide reasonable link volumes on freeways and main arterials, but generally they do not have enough network and zone detail to predict accurate link volumes on collectors or turning volumes at intersections. Common practice is to do an adjustment of the forecast model volumes. A procedure called "Furness" is usually applied which relies on having a recently calibrated model and then comparing the model calibration to counts of that same year, and then adjusting the future volumes based on the difference. However, "Furness" does not work very well when the calibration year is outdated or when new network is introduced into the future networks. The ACCMA model calibration year is 1990 and with future projects like the Hayward Bypass, it was decided that "Furness" could not be used effectively without a year 2000 calibration. So it was concluded that a manual adjustment as described below would be more appropriate which.

The raw model volumes were extracted from the model database and compared to the counts in a spreadsheet format. These volumes were then adjusted based on a comparison to the existing counts, according to the following process.

1. Where the model was predicting very low (or zero) turning volumes compared to counts, the count was substituted for that movement. This occurred at some freeway ramps, where the demand model predicted zero turns at on-ramps and the count showed some significant volume.
2. Where the model network was not configured the same way as the existing network (diamond ramp instead of loop ramp), the model turns were re-organized to match the correct existing movements at that intersection.

So based on this method, the raw model volumes were adjusted to improve the forecasts for more accurate and consistent level of service calculations. It should be cautioned that some inconsistencies may still be present due to the nature and coarseness of the Countywide Model.

Future Conditions -Proposed Project

Future conditions were analyzed based on the recent version of the ACCMA Countywide Model using the 2025 forecast year. There were two scenarios analyzed for 2025, the Proposed Project and the Constrained Project. The Constrained Project is consistent with the 2001 Countywide Transportation Plan (CWTP) in addition to being consistent with the 2001 MTC Regional Transportation Plan (RTP), and essentially represents the baseline network in the ACCMA

Countywide Model. The Proposed Project includes additional unfunded and partially funded projects requested by the City of Hayward.

Table A2 in the Technical Appendix provides the detailed 2025 Proposed Project adjusted model volumes for each turning movement for all study intersections for PM Peak Hour conditions.

Table 4 (Proposed Project LOS) provides a comparison of intersection LOS between the existing condition and the 2025 Proposed Project. Based on these results, 18 of 27 intersections would operate at LOS D or better during the PM Peak Hour in 2025. One intersection operates at marginal conditions (LOS E), while eight intersections operate at LOS F or unacceptable conditions (including Center/B Street & Kelly Street, Foothill Boulevard & A Street, Hesperian & A Street, Industrial Parkway SW & Industrial Parkway, Hesperian & EB-SR 92 Ramps, Clawiter Road & EB-SR 92 Ramps, Hesperian & W. Industrial Parkway and Santa Clara Street & Jackson Street).

The 2025 Proposed Project network is considerably different to the existing road network and reflects a large improvement over the existing condition. So based on these differences it is expected that the model results would cause different impacts that make direct comparison to existing difficult. However, the 2025 results do indicate a trend. The primary improvement is the Hayward Bypass which influences traffic at most of the roads and intersections on the east side of the City, while the I-880 Reliever Route influences roads and intersection impacts on the west side of the City.

A comparison of results in Table 4 between existing and 2025 shows the number of intersections operating at LOS E or F only increases by one, from 8 to 9, but the number of intersections at LOS F doubles from 4 to 8. This shows that the network will be overloaded by 2025 even with the proposed improvements, primarily due to the addition of 24 years of growth in the buildout scenario. The Circulation Element improvements do prevent some roads links and intersections from degrading to LOS E or F conditions. This benefit is noticeable at some existing intersections that currently operate at LOS F and actually improve in 2025. Even though extensive growth has occurred in 2025, the effect of the proposed network has improved conditions by diverting traffic away from former congested locations (e.g.: Foothill/Mission & Jackson Street improves from F to D and Hesperian & Winton Avenue improves from E to C).

A comparison of results for the 2001 Circulation Element Update with the earlier 1998 Circulation Element shows significant differences in impacts. The 2001 Circulation Element Update has used the current ACCMA Countywide model with ABAG Projections 2000, while the 1998 Circulation Element used the older City of Hayward Model that was based on ABAG Projections 94 with network assumptions from the 1995 MTC RTP and CWTP. Furthermore, the Countywide model has less network detail than the City model and this may tend to assign traffic in a different manner. So all of these factors have contributed to different traffic volumes and hence different impacts that cannot always be explained.

Future Conditions -Constrained Project

The Constrained Project includes only funded projects that are consistent with the 2001 MTC RTP and the 2001 CWTP. The primary difference between this scenario and the Proposed Project is the I-880 Reliever Route.

Table A3 in the Technical Appendix provides the detailed 2025 Constrained Project adjusted model volumes for each turning movement for all study intersections for PM Peak Hour conditions.

Table 5 (Constrained Project LOS) provides a comparison of intersection LOS between the 2025 Constrained Project and the 2025 Proposed Project. Based on the results, 16 of 27 intersections would operate at LOS D or better during the PM Peak Hour in 2025. One intersection operates at marginal conditions (LOS E), while 10 intersections operate at LOS F or unacceptable conditions (including Center/B Street & Kelly Street, Foothill Boulevard & A Street, Foothill Boulevard & Jackson Street, Hesperian & A Street, Hesperian & EB-SR 92 Ramps, Clawiter Road & EB-SR 92 Ramps, Clawiter Road & WB-SR 92 Ramps, Hesperian & W. Industrial Parkway, Santa Clara Street & Jackson Road and Hesperian & Winton Avenue). The impacts identified by the model for this scenario are generally consistent with the differences in network between the Constrained network and the Proposed network. The effect on traffic without the I-880 reliever route is to shift traffic impacts from A Street south to Winton Avenue.

Roadway Link Level of Service

Traffic operations were evaluated on the basis of roadway segment level of service. This was done using the ACCMA Countywide Model. The level of service for each roadway segment was determined from the ratio of link volume to link capacity. Congested roads are links identified by LOS E or F conditions. Link LOS was done for both existing and future conditions. However, the City does not have sufficient link counts at every road link to calculate existing link LOS, so the 2005 ACCMA model was used as a substitute for existing conditions. It should be recognized that the 2005 model is a forecast year and not an existing condition, but it was deemed close enough to produce a link LOS chart for existing conditions. **Figure 2** shows congested roadway links for 2005 that operate at LOS E or F conditions. For 2005 conditions, the roadway miles of congested segments was calculated to be about 98 miles in length. This is a very approximate length as it was calculated using a demand model that tends to have a coarse network representation when compared to reality.

Figure 3 shows congested roadway links in 2025 for the Proposed Project that operate at LOS E or F conditions. For the 2025 Proposed Project, the roadway miles of congested segments was calculated to be about 92 miles in length. **Figure 4** shows congested roadway links in 2025 for the Constrained Project that operate at LOS E or F conditions. For the 2025 Constrained Project, the roadway miles of congested segments was calculated to be about 96 miles in length.

Table 1. Level of Service Criteria for Signalized Intersections

Level of Service	Expected Delay	Average Stopped Delay (Seconds/Vehicle)
A	Little or no delay.	≤ 5
B	Good progression and short cycle lengths.	>5 and ≤15
C	Fair progression, longer cycle lengths.	>15 and ≤25
D	The influence of congestion becomes noticeable. Some unfavorable progression and long cycle lengths.	>25 and ≤40
E	Poor progression, long cycle lengths, and cycle failures.	>40 and ≤60
F	Unacceptable to most drivers, arrival-flow rates exceed the capacity of the intersection.	>60

Source: *Chapter 9, HCM-94, Transportation Research Board 1994.*

Table 2. Level of Service Criteria for Unsignalized Intersections

Level of Service	Expected Delay	Average Total Delay (Seconds/Vehicle)
A	Little or no delay.	≤ 5
B	Good progression and short cycle lengths.	>5 and ≤10
C	Fair progression, longer cycle lengths.	>10 and ≤20
D	The influence of congestion becomes noticeable. Some unfavorable progression and long cycle lengths.	>20 and ≤30
E	Poor progression, long cycle lengths and cycle failures.	>30 and ≤45
F	Unacceptable to most drivers, arrival flow rates exceed the capacity of the intersection.	>45

Source: *Chapter 10, HCM-94, Transportation Research Board 1994.*

Table 3. Existing PM Peak-Hour Intersection Levels of Service and Stopped Delay

	INTERSECTION		Scenario: 2001 Existing Conditions		
			Control	Delay (Sec/Veh)	LOS
1	Center St	Kelly St	Signal	20	C
2	Mission Blvd	A St	Signal	25	D
3	Foothill Blvd	A St	Signal	**75**	**F**
4	Mission/Foothill	Jackson	Signal	**322**	**F**
5	NB 880 Ramps	A St	Signal	26	D
6	SB 880 Ramps	A St	Signal	29	D
7	Hesperian Blvd	A St	Signal	43	E
8	Mission Blvd	Carlos Bee Blvd	Signal	49	E
9	Mission Blvd	Harder Rd	Signal	29	D
10	Mission Blvd	Tennyson Rd	Signal	15	B
11	Mission Blvd	Industrial Pkwy	Signal	41	D
12	Industrial Pkwy SW	Industrial Pkwy	Signal	20	C
13	NB-880 Ramps	Whipple Rd	Signal	**98**	**F**
14	SB-880 Ramps	Whipple-Dyer Rd	Signal	25	D
15	NB-880 Ramps	Industrial Pkwy	Signal	9	B
16	SB-880 Ramps	Industrial Pkwy	Signal	14	B
17	Hesperian Blvd	EB-SR92 Ramps	Signal	16	C
18	Hesperian Blvd	WB-SR92 Ramps	Signal	15	B
19	Industrial Blvd	EB-SR92 Ramps	Signal	20	C
20	Industrial Blvd	WB-SR92 Ramps	Signal	11	B
21	Clawiter Rd	EB-SR92 Ramps	4-way Stop	30	D
22	Clawiter Rd	WB-SR92 Ramps	4-way Stop	19	C
23	Hesperian Blvd	W. Industrial Pkwy	Signal	57	E
24	Santa Clara St	Jackson Rd	Signal	**123**	**F**
25	Santa Clara St	Winton Av	Signal	20	C
26	Hesperian Blvd	Winton Av	Signal	51	E
27	Santa Clara St	A St	Signal	20	C
Number of intersections with LOS E or F					8

Source: Dowling Associates, Inc. Selected counts from 1999 through 2001.
LOS calculated using TRAFFIX with 94 HCM methodology with 0.95 PHF

Table 4. Proposed Project PM Peak-Hour Intersection Levels of Service and Stopped Delay

	INTERSECTION		Scenario: 2001 Existing Conditions		Scenario: 2025 Proposed Project	
			Delay (Secs)	LOS	Delay (Secs)	LOS
1	Center St	Kelly St	20	C	**83**	**F**
2	Mission Blvd	A St	25	D	20	C
3	Foothill Blvd	A St	**75**	**F**	**63**	**F**
4	Mission/Foothill	Jackson	**322**	**F**	34	D
5	NB 880 Ramps	A St	26	D	28	D
6	SB 880 Ramps	A St	29	D	13	B
7	Hesperian Blvd	A St	43	E	**584**	**F**
8	Mission Blvd	Carlos Bee Blvd	49	E	19	C
9	Mission Blvd	Harder Rd	29	D	21	C
10	Mission Blvd	Tennyson Rd	15	B	18	C
11	Mission Blvd	Industrial Pkwy	41	D	41	D
12	Industrial Pkwy SW	Industrial Pkwy	20	C	**64**	**F**
13	NB-880 Ramps	Whipple Rd	**98**	**F**	47	E
14	SB-880 Ramps	Whipple-Dyer Rd	25	D	32	D
15	NB-880 Ramps	Industrial Pkwy	9	B	8	B
16	SB-880 Ramps	Industrial Pkwy	14	B	10	B
17	Hesperian Blvd	EB-SR92 Ramps	16	C	**296**	**F**
18	Hesperian Blvd	WB-SR92 Ramps	15	B	17	C
19	Industrial Blvd	EB-SR92 Ramps	20	C	33	C
20	Industrial Blvd	WB-SR92 Ramps	11	B	26	D
21	Clawiter Rd	EB-SR92 Ramps	30	D	**754**	**F**
22	Clawiter Rd	WB-SR92 Ramps	19	C	13	C
23	Hesperian Blvd	W. Industrial Pkwy	57	E	**100**	**F**
24	Santa Clara St	Jackson Rd	**123**	**F**	**487**	**F**
25	Santa Clara St	Winton Av	20	C	21	C
26	Hesperian Blvd	Winton Av	51	E	25	C
27	Santa Clara St	A St	20	C	32	D
Number of intersections with LOS E or F				8		9

Source: Dowling Associates, Inc. Existing Conditions: Selected PM counts from 1999 through 2001.
2025 Project: ACCMA Countywide Model, dated August 2001

Table 5. Constrained Project PM Peak-Hour Intersection Levels of Service and Stopped Delay

	INTERSECTION		Scenario: 2025 Constrained Project		Scenario: 2025 Proposed Project	
			Delay (Secs)	LOS	Delay (Secs)	LOS
1	Center St	Kelly St	**123**	**F**	**83**	**F**
2	Mission Blvd	A St	20	C	20	C
3	Foothill Blvd	A St	**152**	**F**	**63**	**F**
4	Mission/Foothill	Jackson	**63**	**F**	34	D
5	NB 880 Ramps	A St	21	C	28	D
6	SB 880 Ramps	A St	12	B	13	B
7	Hesperian Blvd	A St	**192**	**F**	**584**	**F**
8	Mission Blvd	Carlos Bee Blvd	17	C	19	C
9	Mission Blvd	Harder Rd	21	C	21	C
10	Mission Blvd	Tennyson Rd	18	C	18	C
11	Mission Blvd	Industrial Pkwy	43	D	41	D
12	Industrial Pkwy SW	Industrial Pkwy	23	C	**64**	**F**
13	NB-880 Ramps	Whipple Rd	23	C	47	E
14	SB-880 Ramps	Whipple-Dyer Rd	25	D	32	D
15	NB-880 Ramps	Industrial Pkwy	1	A	8	B
16	SB-880 Ramps	Industrial Pkwy	8	B	10	B
17	Hesperian Blvd	EB-SR92 Ramps	**316**	**F**	**296**	**F**
18	Hesperian Blvd	WB-SR92 Ramps	16	C	17	C
19	Industrial Blvd	EB-SR92 Ramps	36	D	33	C
20	Industrial Blvd	WB-SR92 Ramps	44	E	26	D
21	Clawiter Rd	EB-SR92 Ramps	**603**	**F**	**754**	**F**
22	Clawiter Rd	WB-SR92 Ramps	**55**	**F**	13	C
23	Hesperian Blvd	W. Industrial Pkwy	**144**	**F**	**100**	**F**
24	Santa Clara St	Jackson Rd	**560**	**F**	**487**	**F**
25	Santa Clara St	Winton Av	37	D	21	C
26	Hesperian Blvd	Winton Av	**147**	**F**	25	C
27	Santa Clara St	A St	18	C	32	D
Number of intersections with LOS E or F				11		9

Source: Dowling Associates, Inc. 2025 Project: ACCMA Countywide Model, dated August 2001
2025 Constrained: ACCMA Countywide Model, dated August 2001

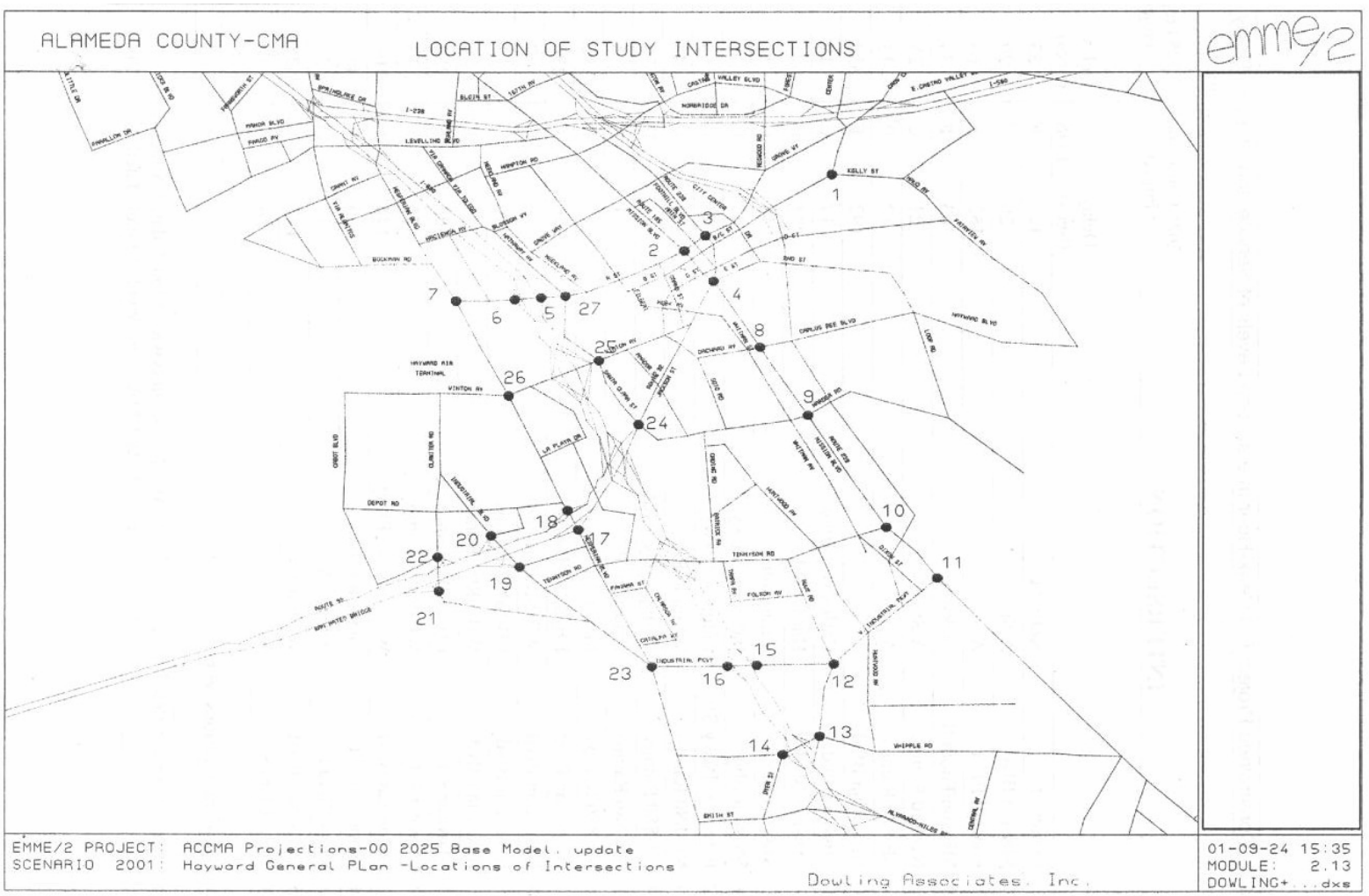

Figure 1
Location of Study Intersections

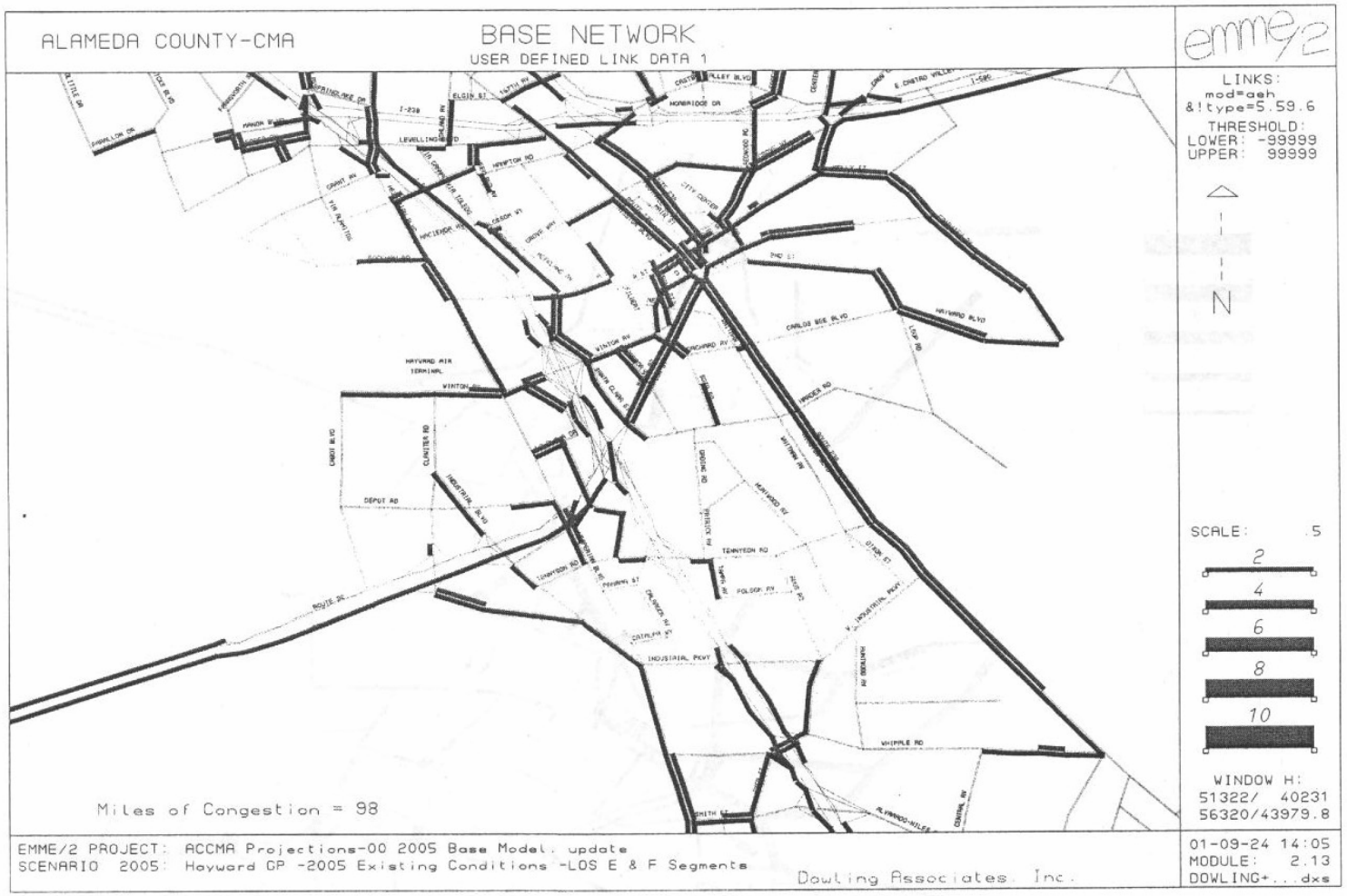

Figure 2
Congested Roadway Segments (LOS E and F)
2005 Existing Conditions Network –PM Peak

Figure 3
Congested Roadway Segments (LOS E and F)
2025 Proposed Project Network –PM Peak

Figure 4
Congested Roadway Segments (LOS E and F)
2025 Constrained Project Network –PM Peak